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Abstract

THE DESIGN AND CONSTRUCTION OF PRE-STRESSED CONCRETE PRESSURE VESSELS WITH PARTICULAR REFERENCE TO OLDBURY NUCLEAR POWER STATION

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The paper is introduced by a brief historical review of the development of commercial nuclear power stations in the U.K. which led to the adoption of pre-stressed concrete pressure vessels containing the whole pressure circuit for the coolant gases.

The basic design requirements are stated and expounded coupled with a brief summary of principles for structural behaviour of the vessel in the elastic range and at ultimate failure. The general design for the liner and cooling system is outlined. The requirements to be met by materials and pre-stressing systems are mentioned.

The interrelation of the vessel shape, pre-stressing methods and plant arrangement is examined for spherical and cylindrical vessels, and the costs compared. The choice of end closures and pre-stressing systems for cylinders is discussed and reasons given for the authors' preferences as adopted at Oldbury.

The general theme is then illustrated by reference to the design and construction of the Oldbury station.

A brief description of the vessel includes main dimensions and arrangement of the pre-stressing system. The methods used for elastic and ultimate analyses are outlined and also the design of the liner, the penetrations, the cooling system and the insulation.

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A description is given of the work undertaken in concrete research and in tests of construction feasibility. Further tests included those of components for the stressing system, liner details and models of end slabs and complete vessels.

An outline description is given of the construction of Oldbury which commenced in 1962.

This covers constructional plant, arrangement of foundations and preparation of the base slab of the vessel. This is followed by the roll-in of the prefabricated part of the liner, and the completion of the vessel liner and concreting. The pre-stressing technique is then described.

The proposals for the proof pressure testing are set down.

The paper concludes with a summary of the advantages of pre-stressed concrete pressure vessels for the containment of nuclear reactor circuits, and an appraisal of their potentialities.